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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/711,700

09/30/2004

Kevin S. Petrarca

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INTERNATIONAL BUSINESS MACHINES CORPORATION

DEPT. 18G

BLDG. 300-482

2070 ROUTE 52

HOPEWELL JUNCTION, NY 12533

EXAMINER

NGUYEN, TRAM HOANG

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 01/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/711,700		PETRARCA ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	Tram H. Nguyen		2818	

aa

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 17 November 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 6-12 and 16-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 13-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 September 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |                                                                                                                                                 |                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                                                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                                            | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>09/30/2004</u> . | 6) <input type="checkbox"/> Other: _____                                                |

**DETAILED ACTION**

**Election/Restriction**

**(Final)**

1. Examiner has noted that the applicant has responded to the election restriction from the last communication response. The applicant has elected Group I claims 1-5 and 13-15 for further examination with traverse. However, it is clear that the examination of the device and method would be an undue burden. Therefore the election requirement is made final.

**Drawings**

2. The drawings are objected to for the following reasons.

Figures 1 and 2 are not designated by a legend such as "Prior Art". The Legend is necessary in order to clarify what applicant's invention is (see MPEP § 608.02g).

Appropriate Correction is required.

**Claim Rejections - 35 U.S.C. § 103**

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claims 1-5 and 13-15 is/are rejected under 35 U.S.C. 103 (a) as being unpatentable over admitted prior art Inoue et al. (hereinafter refer to as Inoue) (U.S. Pub. No. 2002/0090814).

Regarding to **claim 1**, the Background of invention discloses all the limitations of claim 1 (fig.3) except for an impure copper seed layer derived from an impure copper source with a content of impurities that is deposited on a barrier layer (reference numeral 16). However, the feature is shown by Inoue (fig.1B, reference numeral 18; par. 33). Therefore, it is considered obvious to one of ordinary skill in the art, at the time the invention was made, to include the memory element as shown by Inoue to the admitted Prior Art so that obtaining an adequate side coverage, the aspect ratio of barrier layer is substantially creased, and clogging at the opening of the hole can occur upon the impure copper filling into the underlying insulating later because the action of noble metal having much larger atomic weight than copper (pg. 3, par. 35, lines 5-8).

Regarding to **claim 2**, the admitted Prior Art and Inoue disclose all the limitations of the claimed invention; plus, Inoue also teaches said copper source of said impure copper seed layer is equivalent to said copper source of said impure copper because the copper in the impure copper seed layer and the electroplated copper are both derived from a source with an impurity content of not more than 1.2 % by weight and not less than or equal to 0.001% by weight (pg. 2, par. 33, lines 11-14).

Therefore, it is considered obvious to one of ordinary skill in the art, at the time the invention was made, to include the memory element as shown by Inoue to the

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admitted Prior Art so that it improve coverage properties of the former seed layer(par. 34, lines 7-8)

Regarding to **claim 3**, the admitted Prior Art and Inoue disclose all the limitations of the claimed invention; moreover, Inoue also teaches the copper in the impure copper seed layer and the electroplated copper are both derived from a source with an impurity content of not more than 1.2 % by weight and not less than or equal to 0.001% by weight (pg. 2, par. 33, lines 11-14).

Therefore, it is considered obvious to one of ordinary skill in the art, at the time the invention was made, to include the memory element as shown by Inoue to the admitted Prior Art so that it improve coverage properties of the former seed layer (par. 34, lines 7-8).

Regarding to **claim 3**, the admitted Prior Art and Inoue disclose all the limitations of the claimed invention; furthermore, the Applicant admits the copper in the impure copper seed layer and the electroplated copper are both derived from a source with an impurity content of not more than 1.2 % by weight and not less than or equal to 0.001% by weight are general well-known impure copper sources (present invention specification: pg. 5, par. 20, lines 4-9).

Regarding to **claims 4 and 14**, the admitted Prior Art and Inoue disclose all the limitations of the claimed invention; since the copper in the impure copper seed layer and the electroplated copper are both derived from a source with an impurity content of not more than 1.2 % by weight and not less than or equal to 0.001% by weight.

Therefore, the composition of the impure copper seed layer and electroplated copper remains substantially similar.

Regarding to **claims 5 and 15**, the admitted Prior Art and Inoue disclose all the limitations of the claimed invention; and Inoue teaches said copper in said impure copper layer source comprises impurities of silver (pg. 2, par. 33, lines 4-8).

Regarding to **claim 13**, the admitted Prior Art discloses a copper interconnect (fig. 3) comprising:

an insulating layer that has an opening (fig. 1, reference numeral 115);

a barrier layer that prevents substantial diffusion of copper through to said underlying insulating layer that is deposited on said underlying insulating layer and lines said opening; (fig.2, reference numeral 230);

The Prior Art fails to disclose an impure copper seed derived from an impure copper seed source with a content of impurity that is deposited on said barrier layer and fills said opening. However, the features are shown by Inoue (fig.1B, reference numeral 18; par. 33). Therefore, it is considered obvious to one of ordinary skill in the art, at the time the invention was made, to include the memory element as shown by Inoue to the admitted Prior Art so that obtaining an adequate side coverage, the aspect ratio of barrier layer is substantially creased, and clogging at the opening of the hole can occur upon the impure copper filling into the underlying insulating later because the action of noble metal having much larger atomic weight than copper (pg. 3, par. 35, lines 5-8).

**Conclusion**

5. A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tram H. Nguyen whose telephone number is (571)272-5526. The examiner can normally be reached on Monday-Friday, 8:30 AM – 5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on (571)272-1787. The fax numbers for all communication(s) is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1625.

THN

Tram H. Nguyen  
Art Unit 2818  
12/29/2005.

  
David Nelms  
Supervisory Patent Examiner  
Technology Center 2800